

TABLE 1-continued

Fabric Construction	Print Resolution (before & after 15 washings)		Hand	Drape	Opacity	Comfort	Pilling Resistance* (with & wo cotton fibers)	
100% polyester Comfortrel® (Example 2)	5	3	4	1	2	3	2	—
Plating poly to face and cotton to back (Example 3)	3 (grin thru)	2	4	4	4	3	2.5	—
Double-knit with ploy to face and cotton to back (Example 4)	5	3.5	3	4	4+	4-	2.5	2
Double-knit w/ Comfortrel® to face and cotton to back (Example 5)	5	3.5	4	4	4+	4+	2.5	3
Double-knit with high tenacity, air jet spun polyester yarn to face and cotton to back (Example 6)	5	5	4	4	4+	4+	3.0	4

\*pilling resistance was tested according to ASTM D3512-82 test method both with and without the introduction of cotton fibers into the test chamber.

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As can be seen, 100% polyester had good print resolution after washing but poor hand, drape, opacity and comfort. Surprisingly, its pilling resistance was only average. Substituting Comfortrel®, variable staple length fibers improved hand, opacity and comfort but, surprisingly, did not help drape or pilling resistance.

As can also be seen, plating the polyester with cotton did improve hand, drape, opacity and comfort but "grin through" and pilling resistance were only average. In addition, the plating process was hard to control and, as a result, the placement of the yarns varied.

To the contrary, the double knitted fabric of the present invention (examples 4-6) produced very good print resolution after washing with high hand, drape, opacity and comfort values. In addition, the use of Comfortrel® fibers (example 5) further improved the hand but, surprisingly, did not improve the pilling resistance of the polyester face.

However, surprisingly, the use of higher tenacity yarns (example 6) substantially eliminated that shortcoming while, at the same time, maintained the other critical values of print resolution after washing, hand, drape, opacity and comfort. The original Comfortrel® fibers had a tenacity of about 3 grams/denier. The higher tenacity yarns (example 6) had a tenacity of about 6 grams/denier and, unexpectedly, did not pill. This is contrary to the generally excepted idea of reducing the tenacity of the synthetic yarns when pilling occurs to allow the pills to more easily break off.

In the most preferred embodiment, shown in example 6, the high-tenacity, staple synthetic fiber is polyester having a denier of less than about 1.5 and preferably about 1. Also, the staple length of this high-tenacity, synthetic fiber was about 1.5 inches but variable lengths up to about 1.5 inches would be expected to work as well. The above data illustrates that a knitted fabric constructed according to the present invention is print receptive and pill resistant, thereby providing excellent print resolution even after 15 home washings.

An article of apparel formed from the fabric of the present invention may be printed using, for example, a Sawgrass Sublijet ink system in an Epson 3000 ink jet printer and transferring the image to the polyester print receptive surface. Preferably, the image is composed using conventional desktop publishing software, such as Hanes T-ShirtMaker, and printed on high-quality ink jet transfer paper, such as "ColorTrans" paper from Wyndstone. The actual transfer to the apparel may be done using an Insta-Graphic heat press set at about 400 degrees F and pressing for about 20 seconds.

Certain modifications and improvements will occur to those skilled in the art upon a reading of the foregoing description. By way of example, the substantially 100% cellulosic layer could be altered to include a blend of natural and synthetic fibers for particular applications and markets. Similarly, the substantially 100% polyester layer could be altered to include other synthetic fibers for particular applications and markets. Also, finishes may be applied to the fabric either during knitting or afterwards to further improve desirable fabric characteristics, such as shown in Table 1. It should be understood that all such modifications and improvements have been deleted herein for the sake of conciseness and readability but are properly within the scope of the following claims.

What is claimed is:

1. A print-receptive, pill-resistant, knitted fabric, said fabric knitted from yarn formed from high-tenacity, staple synthetic fiber having a tenacity value of greater than about 4 grams/denier, wherein said knitted fabric has a pilling resistance value of greater than about 3 and wherein said knitted fabric is a double-knit fabric having a front side and a back side, the front side being formed from said high-tenacity, staple synthetic fiber and the back side being substantially formed cellulosic yarn, said cellulosic yarn being selected from the group consisting of cotton and synthetic cellulosic fibers.

2. The knitted fabric of claim 1, wherein the back side of said fabric is substantially 100% spun cotton fiber.

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3. The knitted fabric of claim 1, wherein the front side and back side of said fabric are a single jersey knit construction.

4. The knitted fabric of claim 1, further including a tie yarn between the front and back of said fabric.

5. The knitted fabric of claim 1, wherein the high-tenacity, staple synthetic fiber has a tenacity of about 6 grams/denier.

6. A print-receptive, pill-resistant, knitted fabric, said fabric knitted from yarn formed from high-tenacity, staple synthetic fiber having a tenacity value of greater than about 4 grams/denier, wherein said knitted fabric has a pilling resistance value of greater than about 3, and said high-tenacity, staple synthetic fiber is selected from the group consisting of air jet spun polyester; nylon; acrylic; and polypropylene, and wherein said knitted fabric is a double-knit fabric having a front side and a back side, the front side being formed from said high-tenacity, staple synthetic fiber and the back side being substantially formed from cellulosic yarn, said cellulosic yarn being selected from the group consisting of cotton and synthetic cellulosic fibers.

7. The knitted fabric of claim 6, wherein the back side of said fabric is substantially 100% spun cotton fiber.

8. The knitted fabric of claim 6, wherein the front side and back side of said fabric are a single jersey knit construction.

9. The knitted fabric of claim 6, further including a tie yarn between the front and back of said fabric.

10. The knitted fabric of claim 6, wherein the high-tenacity, staple synthetic fiber has a tenacity of about 6 grams/denier.

11. The knitted fabric of claim 6, wherein said high-tenacity, staple synthetic fiber is polyester.

12. The knitted fabric of claim 6, wherein said high-tenacity, staple synthetic fiber has a denier of less than about 1.5.

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13. The knitted fabric of claim 12, wherein said high-tenacity, staple synthetic fiber has a denier of about 1.

14. The knitted fabric of claim 6, wherein the staple length of said high-tenacity, synthetic fiber is about 1.5 inches.

15. The knitted fabric of claim 14, wherein the staple length of said high-tenacity, synthetic fiber is variable up to about 1.5 inches.

16. A printed, pill-resistant, article of apparel, said article of apparel knitted from yarn formed from high-tenacity, staple synthetic fiber having a tenacity value of greater than about 4 grams/denier, wherein said article of apparel has a pilling resistance value of greater than about 3 and wherein said knitted fabric is a double-knit fabric having a front side and a back being substantially formed from cellulosic yarn, said cellulosic yarn being selected from the group consisting of cotton and cellulosic fibers.

17. A printed, pill-resistant, article of apparel, said article of apparel knitted from yarn formed from high-tenacity, staple synthetic fiber having a tenacity value of greater than about 4 grams/denier, wherein said article of apparel has a pilling resistance value of greater than about 3, and said high-tenacity, staple synthetic fiber is selected from the group consisting of air jet spun polyester; nylon; acrylic; and polypropylene, and wherein said article of apparel is formed from a double-knit fabric having a front side and a back side, the front side being formed from said high-tenacity, staple synthetic fiber and the back side being substantially formed from cellulosic yarn, said cellulosic yarn being selected from the group consisting of cotton and synthetic cellulosic fibers.

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